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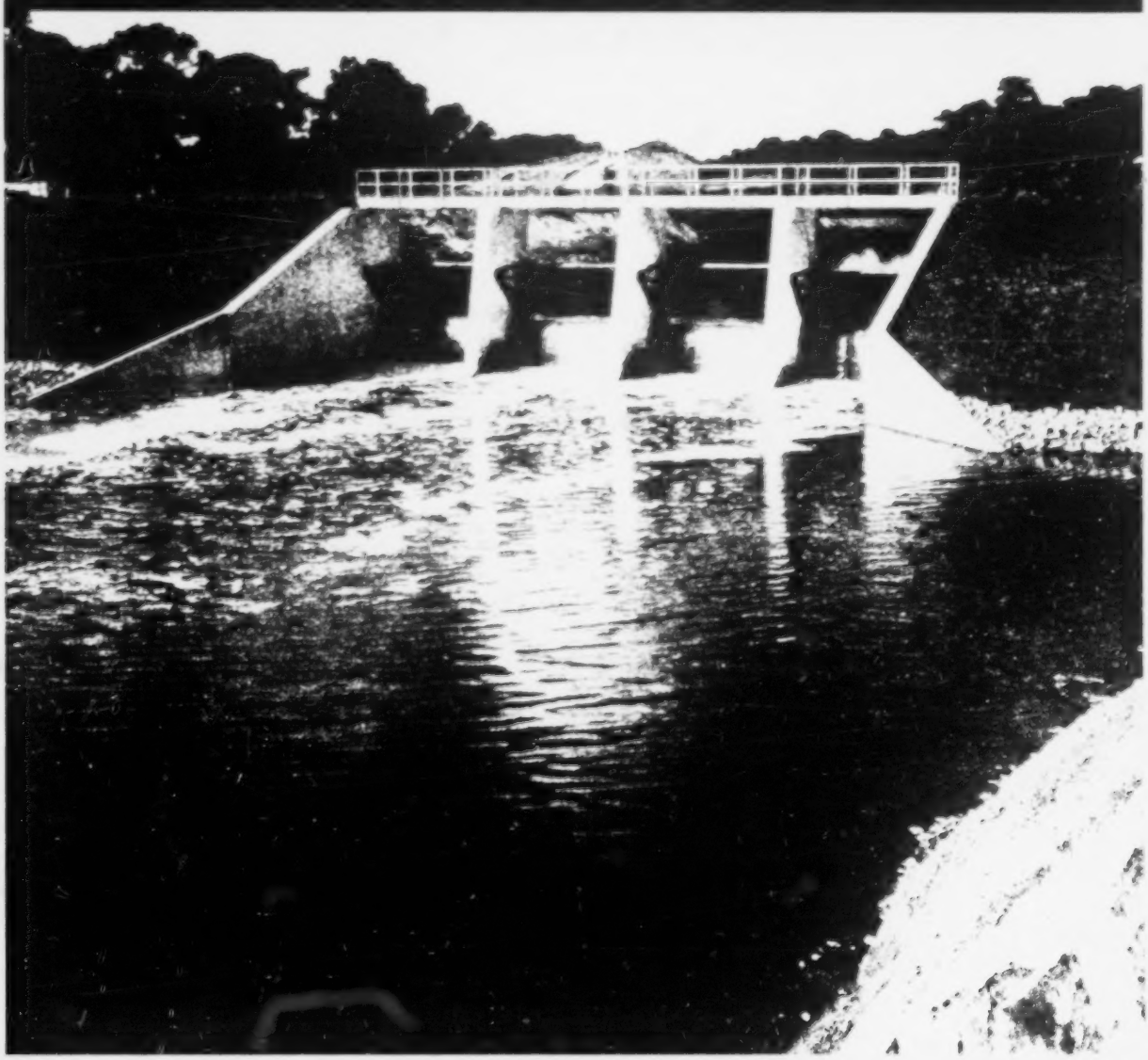
Financing Municipal Water Supply Systems



A SPECIAL STUDY

FINANCING MUNICIPAL WATER SUPPLY SYSTEMS

The Congress of the United States
Congressional Budget Office

NOTE

All years referred to in this report are fiscal years unless otherwise indicated.

PREFACE

This paper assesses the extent to which the financing of local water supply facilities will burden state and local governments in the next two decades, and suggests alternatives by which federal, state, and local governments can reduce water supply expenditures. This paper responds to a request by the Senate Committee on Environment and Public Works.

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SUMMARY

Concern that localities would be unable to finance needed water supply facilities prompted the 99th Congress to consider (and the House to pass) bills that would have significantly expanded the federal role in financing municipal water supply systems. Similar legislation is likely to be introduced in the current Congress. Paradoxically, the last Congress also reduced funding for existing programs that support these systems. The Administration's budget for fiscal year 1988 seeks further reductions in most of these programs.

From fiscal years 1977 through 1983, water utilities spent an average $4.7 billion annually to replace and expand local water supply facilities. Nationwide, capital spending per capita averaged $25 per year. Spending across regions varied widely, from $10 per capita in the Mid-Atlantic region to $54 per capita in the Mountain states. The CBO projects that for the United States as a whole, annual capital spending for local water supply will be 11 percent less per capita from 1984 through 2000 than it was in the 1977-1983 period. In six of the nine Census regions, capital spending will fall, declining between 3 percent in the New England area and 32 percent in the South Atlantic region. Capital spending will rise in three regions, but in two of these regions, the increase will be less than 10 percent. In only one region, the Mid-Atlantic, will per capita capital expenditures rise sharply--by over 40 percent.

STATE AND LOCAL POLICY OPTIONS

State and local governments could pursue a number of strategies to reduce the amount of capital investment that will be needed for water supplies. These include promoting water conservation through price reform and consumer education, adopting less capital-intensive water supply technologies, and taking advantage of recent financial innovations.

Reforming price schedules holds particular promise, because many public water utilities charge prices that are less than the full cost of supplying water. Lacking signals about the true cost of water, consumers use more than they would if they had to pay for the full cost of their consumption. The result is overinvestment in water supply facilities.

In the 17 western states where existing water rights exceed the average supply, state governments could also encourage more efficient use of water by allowing markets a greater role in allocating the existing water supply. Markets work well only if there are unambiguous, transferable, and quantifiable property rights attached to the good being traded. Under current law, such rights rarely exist for water. Despite the difficulties raised by current law, voluntary water transfers do occur and have become more common in recent years. While most transfers result from individual negotiations among the affected parties, some fledgling water markets have been started. That these transfers take place, despite the lack of supporting institutions and despite the legal complexities involved, suggests that far more transfers would occur if the legal and institutional climate were more conducive to trade.

For most areas in the eastern United States, water is not scarce, but simply inefficiently distributed--that is, individual systems sometimes experience large shortfalls while the water-basin as a whole has an abundant supply. A water-short system could build new capital facilities to import water from outside the basin. Alternatively, the system could pursue the less expensive method of connecting and jointly operating the individual systems in a region. The greatest barrier to system interconnection is a lack of information. State governments could serve the role of "honest broker," developing and disseminating information that could be expensive for an individual locality to acquire, but crucial to the prospects of any joint operating agreement.

Finally, states could create a legal and institutional climate that minimized the cost of capital for local water utilities. In general, state governments could increase the range of financial instruments available to local water authorities. States also could use their stronger position in credit markets to assist localities more directly. For example, states could establish bond pools for local issues, which would help issuers take advantage of the economies of scale that characterize credit markets.

FEDERAL POLICY ALTERNATIVES

By providing support for municipal water supplies, the federal government has sought to further several goals, including increasing the availability and quality of local water supplies, promoting efficient state and local water supply policies, and increasing local economic development. When considering the direction of future federal policies for water supply, the Congress might wish to add a further goal: reducing the federal deficit. Several approaches to meet the last goal are discussed below.

Reduce or Eliminate Federal Grants and Loans for Local Water Supply

The Administration's budget request for fiscal year 1988 calls for a sharp reduction of federal grants and loans for constructing facilities for municipal water supplies. The Administration's proposals would lower federal spending by more than $200 million annually compared with spending under current law.

Maintain Current Support for Municipal Water Supplies

By restructuring existing programs, the Congress could maintain the existing level of federal support for municipal water supply, while furthering other goals such as reducing the federal deficit.

Facilitate Voluntary Transfers of Federally Controlled Water. Nearly all water rights, including rights to water from federal water projects, are held under state law. In those states that encourage water transfers, however, the federal role could be significant. Bureau of Reclamation projects deliver nearly 20 percent of western agricultural water, and users of that water must comply with federal as well as state rules governing its distribution. Trading water rights would reduce the cost of local water supplies (by reducing the need to build more expensive capital projects), while increasing federal revenues by raising both income taxes and payments to the Bureau of Reclamation.

Restructure Requirements for FmHA Loans and Grants. The Farmers Home Administration (FmHA) provides grants and loans to small, low-income communities in order to promote investment in water supply facilities. The current structure of the FmHA's program unintentionally also encourages localities both to choose inefficient, capital-intensive facilities and to maintain those facilities poorly.

The Congress could address these problems through a number of alternatives. First, the FmHA could provide technical and financial advice directly to communities. The cost of this service would partially be offset by the increased efficiency of investments by FmHA program beneficiaries. Second, as part of the grant application, the FmHA could require communities to examine specific alternative solutions to their water supply problems. While this would bring a variety of alternatives to the attention of local water supply officials, it might increase the importance of grantsmanship in determining which communities receive FmHA funding, making the efficient provision of water supply facilities relatively less important. Finally, FmHA grants and loans could be conditioned on the willingness of recipients to comply with a specific maintenance schedule. Publishing these

schedules would be useful for local officials unsure of the optimal maintenance timetables for their plants. The requirement that communities must follow predetermined maintenance schedules, however, would carry with it the danger that such schedules would disregard local conditions or be too expensive to develop properly.

Revolving Fund for Local Water Supply Facilities. Current grant and loan programs for water supply could be combined and used to capitalize a revolving fund. The fund would make low-interest loans to states and localities for use in expanding or rehabilitating water supply systems. Loan repayments would be used to make further loans. Earmarking funds for water supply would make federal subsidies more predictable. If earmarking reduced the frequency of Congressional review, however, allocations would be less likely to reflect Congressional spending priorities.

CHAPTER I

INTRODUCTION

Concern that localities would be unable to finance water supply facilities prompted the 99th Congress to consider bills that would have significantly expanded the federal role in financing municipal water supply systems. Similar legislation is likely to be introduced in the current Congress. Paradoxically, the last Congress also reduced funding for existing programs that support municipal water supply systems. The Administration's budget for fiscal year 1988 seeks further reductions in most of these programs. This paper assesses the extent to which the financing of local water supply facilities will impose an increasing burden on state and local governments in the next two decades.

CHARACTERISTICS OF MUNICIPAL WATER SYSTEMS

Any governmental effort to assist the water supply industry must take account of the remarkably heterogeneous nature of that industry. This section briefly discusses some of the financial and operating characteristics of municipal water supply companies.

Size and Ownership. There are about 59,000 water supply systems in the United States. A few of these systems are quite large, but most are small; only 1.1 percent of all systems serve more than 44 percent of the population, while 65 percent of all systems supply water to less than 3 percent of the population. 1/

Municipal water utilities are owned either publicly or privately. The publicly owned municipal water supply systems provide water to the greatest number of people, with some 26,000 systems serving 71 percent of

1. Unless otherwise noted, the information presented in this chapter comes from three sources: Environmental Protection Agency, Office of Drinking Water, *Survey of Operating and Financial Characteristics of Community Water Systems* (prepared by Temple, Barker, and Sloan, Inc., October 1982); Environmental Protection Agency, Office of Drinking Water, *Fiscal Year 1983 Status Report: The National Public Water Supply Program* (1984); and U.S. Geological Survey, *National Water Summary 1985* (1986).

the U.S. population. Of these, the largest 500 systems serve 39 percent, while the smallest 20,000 systems together serve less than 7 percent. On average, each publicly owned system supplies water to 7,500 people (see Table 1).

Regulated investor-owned utilities and smaller, unregulated systems owned by homeowners associations serve another 13 percent of the U.S. population. These 16,000 privately owned utilities average about a third the size of publicly owned systems. Mobile home parks, hospitals, schools, and other institutions own and operate about 17,000 small, ancillary systems; on average, these systems serve about 60 people each. About 15 percent of the U.S. population has private wells, and another 1 percent has no piped water supply.

Pricing Policies. Publicly owned utilities almost always charge less for water than do their privately owned counterparts. The lower prices stem in part from the tax-exempt status accorded publicly owned agencies; unlike private firms, the production costs of public utilities include no tax payments. More important, public utilities' fees need not cover their full costs of production; local tax revenues or intergovernmental grants can make up any deficit.

Thus, while both public and private utilities usually set prices that are more than sufficient to cover operating costs, only private utilities routinely charge enough to cover fully not only operating costs but also the depreciation of capital facilities. For example, a recent survey found that the ratio of operating revenues to operating expenses averaged only 1.19 for publicly owned utilities, compared with 1.59 for those owned privately. 2/

Private and public utilities also differ in the relative prices that they charge households and industrial users. Public utilities generally charge households about 20 percent more than they charge commercial users; private firms, in contrast, charge households about 50 percent more (see Table 2).

Most water utilities, both private and public, use a two-tier rate structure: customers pay both a monthly or annual flat fee and a fee per unit of water used. Larger systems are most likely to use "declining block rates," in which the fee for water use falls as the amount consumed rises, as

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2. Environmental Protection Agency, Office of Drinking Water, *Survey of Operating and Financial Characteristics*, pp. iv-10.

TABLE 1. SIZE AND OWNERSHIP OF MUNICIPAL WATER SUPPLY SYSTEMS, BY NUMBER OF PEOPLE SERVED

Ownership	Fewer than 3,300	3,301-10,000	10,001-25,000	25,001-50,000	50,001-75,000	75,001-100,000	Over 100,000	Total
All Systems								
Number of systems	52,212	3,851	1,243	1,163	224	101	276	59,071
Percent of systems	88.4	6.5	2.1	2.0	0.4	0.2	0.5	100
Percent of U.S. population served	8.5	7.9	7.4	15.3	5.0	3.1	36.7	84
Publicly Owned Systems								
Number of systems	20,476	3,454	1,057	944	182	82	229	26,424
Percent of public systems	77.5	13.1	4.0	3.6	0.7	0.3	0.9	100
Percent of U.S. population served	6.4	7.1	6.4	12.6	4.1	2.6	31.9	71
Privately Owned Systems								
Number of systems	14,830	397	186	219	42	19	47	15,740
Percent of private systems	94.2	2.5	1.2	1.4	0.3	0.1	0.3	100
Percent of U.S. population served	1.6	0.9	1.1	2.8	0.9	0.6	5.1	13.0
Ancillary Systems								
Number of systems	16,907	0	0	0	0	0	0	16,907
Percent of ancillary systems	100	0	0	0	0	0	0	100
Percent of U.S. population served	0.6	0	0	0	0	0	0	0.6

SOURCE: Congressional Budget Office from Environmental Protection Agency, Office of Drinking Water, *Survey of Operating and Financial Characteristics of Community Water Systems* (prepared Temple, Barker, and Sloan, Inc., October 1982.)

TABLE 2. AVERAGE WATER PRICES, BY NUMBER OF PEOPLE SERVED
(In 1982 dollars per 1,000 gallons)

	1,001-3,300	3,301-10,000	10,001-25,000	25,001-50,000	50,001-75,000	75,001-100,000	100,001-500,000	500,001-1,000,000	Over 1,000,000
Public Utilities									
Residential	1.51	1.23	0.94	1.08	1.02	0.84	0.91	0.66	0.62
Commercial/ Industrial	1.01	1.29	0.76	0.82	0.80	0.93	0.61	0.55	0.51
Private Utilities									
Residential	1.98	1.69	1.65	1.56	1.32	1.28	1.63	1.25	0.85
Commercial/ Industrial	1.35	1.26	0.97	1.03	0.83	0.98	1.07	1.07	0.56

SOURCE: Congressional Budget Office from Environmental Protection Agency, Office of Drinking Water, *Survey of Operating and Financial Characteristics of Community Water Systems* (prepared by Temple, Barker, and Sloan, Inc., October 1982).

shown in Table 3. The accompanying box defines the various rate structures used by public and private utilities.

Sources of Capital. A variety of sources provide capital for water supply investments. Available evidence suggests that tax-exempt bonds supply about half of the capital used by water supply utilities. Retained earnings make up another 20 percent to 30 percent. Intergovernmental aid, taxable bonds, and proceeds from the sale of stock together contribute about 10 percent. Bank loans and special tax assessments provide the remainder. 3/

The source of investment funds varies with the size and ownership of water systems. Large public utilities rely mainly on funds borrowed in the tax-exempt bond market; their private counterparts use proceeds from the sale of stocks and taxable bonds instead. Small public utilities rely more on retained earnings, supplementing these with federal aid and tax-exempt bonds. Small privately owned utilities also depend on retained earnings, but substitute private bank loans for tax-exempt debt and federal aid.

THE FEDERAL ROLE IN MUNICIPAL WATER SUPPLY

Various federal policies subsidize both public and private water utilities. The tax code provides the largest subsidies: the interest on state and local bonds issued on behalf of public or private water utilities is tax exempt. This tax exemption lowers water utility borrowing costs by about 20 percent, since tax-exempt bonds can be sold with lower interest rates than can their taxable private counterparts. These bonds provide only limited tax benefits to private utilities, however, since private facilities financed with tax-exempt bonds must be depreciated more slowly than otherwise would be true. In 1983, state and local governments issued $2.75 billion in tax-exempt bonds on behalf of water utilities; $2.6 billion specifically aided public utilities. The tax exemption on the 1983 bond issues will lower federal revenues by roughly $100 million per year over the life of the bonds.

Direct federal spending for water supply facilities benefits only public water utilities and has a rather narrow focus: to stimulate economic de-

3. Based on data from the Public Security Association; the Bureau of Economic Analysis; Environmental Protection Agency, *Survey of Operating and Financial Characteristics*; and John Boland, *Water and Wastewater Pricing and Financial Practices in the U.S.*(prepared for the Agency for International Development, Near East Bureau, 1983).

velopment and to help low-income communities afford improvements in their water supply facilities. Three federal agencies administer programs whose primary purpose is to improve municipal water supply facilities. Three other agencies manage programs intended to promote regional economic development generally; improving local water facilities is only one of many purposes towards which program funds may be put.

TABLE 3. PERCENT OF VARIOUS RATE STRUCTURES USED BY PUBLIC AND PRIVATE UTILITIES IN FISCAL YEAR 1982, BY NUMBER OF PEOPLE SERVED

Rate Structure	Small (500 - 1000)		Medium (25,000-50,000)		Large (500,000-1,000,000)	
	Public	Private	Public	Private	Public	Private
Flat Fee	13	26	4	0	5	0
Flat Rate	6	0	15	0	15	0
Two-Tiered Flat System	29	26	28	15	10	0
Declining Block						
Pure	23	4	20	10	10	14
Two-tiered	15	18	20	54	25	29
Increasing Block						
Pure	4	2	2	0	0	0
Two-tiered	0	0	2	3	0	14
Other a/	8	20	8	18	35	43

SOURCE: Congressional Budget Office from Environmental Protection Agency, Office of Drinking Water, *Survey of Operating and Financial Characteristics of Community Water Systems* (prepared by Temple, Barker, and Sloan, Inc., October 1982).

NOTE: The accompanying box defines the rate schedules displayed in this table.

a. Other = rate structures not otherwise included above. Also includes systems which have different types of rate structures for different customer classes.

DEFINITIONS OF RATE SCHEDULES USED BY WATER UTILITIES

Flat Fee: flat fee paid monthly or annually, not based on water use.

Flat Rate: constant flat rate per unit of water use.

Two-Tiered Flat System: combination of the above rate structures--that is, flat fee plus flat rate.

Pure Declining Block: charge per unit of water declines with increasing water use.

Two-Tiered Declining Block: declining block rate with initial minimum charge covering specified amount of water use.

Pure Increasing Block: charge per unit of water increases with increasing water use.

Two-Tiered Increasing Block: increasing block rate with initial minimum charge covering specified amount of water use.

The **Farmers Home Administration** (FmHA) funds the construction, repair, expansion, and first-year operating expenses of water facilities in rural communities with populations under 10,000. In fiscal year 1985, the FmHA lent about 70 percent of its funds; the remainder was given as grants to communities that could not pay "reasonable user charges" (measured by the ratio of debt service to median local income).[4/] The FmHA distributes funds based on each state's rural population and the number of its households below the poverty level. Outlays under this program peaked in fiscal year 1979 at about $1.2 billion, and have fallen since to $470 million in 1985.

4. Since 1982, FmHA has made loans at three sets of interest rates: communities with median household income below the poverty line and with water systems that violated state or county health codes have paid a "poverty level" interest rate; communities with median household income between 80 and 100 percent of the U.S. median income pay an intermediate rate; and communities with median household income above the U.S. nonmetropolitan median income have paid a "market rate." In 1985, 42 percent of all FmHA loans carried market rates of 8.6 percent to 10 percent, 39 percent of the loans carried intermediate rates of 6.8 percent to 7.5 percent, and 19 percent carried the poverty rate of 5 percent.

The Water Supply Act of 1958 authorizes both the **Army Corps of Engineers** and the **Bureau of Reclamation** to include storage for municipal water supplies in their ongoing multipurpose water projects. Neither agency, however, may build single-purpose water supply projects. Funding for the water supply portion of corps and bureau projects is provided partly by state and local agencies. Until 1986, these agencies paid about 71 percent of the combined construction and operating costs for bureau projects and 54 percent for corps projects. The Water Resources Development Act of 1986 requires state and local agencies to pay the entire cost of all corps projects that they request. 5/

The **Department of Housing and Urban Development** administers **Community Development Block Grants** (CDBGs), the largest of the economic development programs. CDBGs can be used to fund projects that aid low- and moderate-income people or alleviate conditions that pose an immediate threat to a community's health or welfare. The grants sometimes are used to improve public facilities like water and sewer systems. CDBGs are distributed as entitlements to communities of 50,000 or more. These communities receive block grants whose size depends on population, poverty, and overcrowding in each community. Each block grant recipient decides which projects to fund with CDBG money. Communities of fewer than 50,000 people are eligible for CDBG "discretionary" funds. Unlike entitlements, these funds are awarded on a project-by-project basis. During the last several years, about $40 million to $50 million a year in block grants and $100 million to $200 million annually in discretionary grants have been used for water supply projects.

The **Appalachian Regional Commission** (ARC) and the **Economic Development Administration** (EDA) provide economic development funds to needy states, counties, and cities. These funds, awarded on a project-by-project basis, can cover up to 80 percent of a project's cost. Since 1965, annual spending for water supply projects under EDA's program has fluctuated between $35 million and $45 million, while ARC spending for water supply has remained at about $10 million per year.

In total, direct federal spending for local water supplies averaged $738 million a year from fiscal years 1967 through 1976. Federal spending doubled during the next five years, but then fell back to an average $785 million annually from 1982 through 1985. From 1967 through 1976, direct federal outlays for water supply comprised about 18 percent of all public

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5. For an historical perspective on cost sharing, see Congressional Budget Office, *Efficient Investments in Water Resources: Issues and Options* (August 1983).

capital expenditures for water supply. Federal outlays rose to an average of 27 percent of public capital investment from 1977 through 1981 and then fell to its earlier level from 1982 through 1985.

RECENT LEGISLATIVE PROPOSALS

In the last two years, the Congress has considered measures that would have taken the federal role in water supplies in quite different directions. The Administration's recent budget requests have consistently called for curtailing federal aid for water supply, while some Congressional proposals have sought to increase the federal presence.

The Administration's Fiscal Year 1988 Budget Proposal. The President's budget proposal for fiscal year 1988 would sharply reduce or completely eliminate most of the federal programs that aid water supplies. The Administration would eliminate EDA, ARC, and the water supply component of FmHA, and reduce funding for CDBGs (see Table 4). By 1990, direct federal spending for water projects would equal no more than 10 percent of all projected public capital spending for water supply facilities.

The Water Resources Development Act of 1986. The 99th Congress passed an omnibus water bill, the first since 1970. The act authorized the construction of a host of new water resources projects, including improvements to inland waterways and flood control systems. The bill also changed the formulas by which the cost of these projects is divided between federal and nonfederal agencies. In general, nonfederal agencies will be required to pay for a significantly larger share of costs on the projects that they request.

The House-passed version of this bill would have established a new federal loan program, administered by the Army Corps of Engineers, to rehabilitate municipal water supply systems. The program would have provided low-interest loans to both public water utilities and investor-owned water systems operating under state regulation. In general, these loans could have covered up to 80 percent of the cost of projects that rehabilitate or improve water systems. The loan ceiling could have been exceeded if a project served remote areas or if the Secretary of the Army found "economic reasons" for doing so. All loans would have been conditioned on the recipient establishing a water conservation program that included, among other things, rate reform and education campaigns to promote water conservation. Neither the Senate version of the bill nor the final act included the House loan program.

Infrastructure Revolving Funds. Concern about the adequacy and efficiency of overall federal infrastructure spending has prompted Congressional consideration of a number of bills that would have established revolving funds to finance state and local infrastructure spending, including water supply fa-

TABLE 4. FEDERAL SPENDING FOR WATER SUPPLY, BY FEDERAL AGENCY, FISCAL YEARS 1986-1988 (In millions of current dollars)

Federal Agency	Current Policy 1986 Outlays (Actual)	Current Policy 1987 Outlays (Estimated)	Administration Proposal for 1988 Outlays (Estimated)
FmHA			
Loans a/	170	176	0
Grants	120	115	117
HUD-Community Development Block Grants	200	196	179
Economic Development Administration Grants	15	15	10
Appalachian Regional Commission	10	10	10
Bureau of Reclamation	140	140	168
Corps of Engineers	50	40	20
Total	705	692	504

SOURCE: Congressional Budget Office.

a. New loan obligations.

cilities. 6/ Though differing in many particulars, these bills shared two important characteristics. First, all would have provided funds for the construction and repair of a wide variety of infrastructure projects; each state and local government would allocate its share of this money according to its own infrastructure priorities. Second, the revolving fund would have assured a permanent source of infrastructure funds; loan repayments would have been used to make further loans.

The bills often differed in other respects, such as: how to capitalize the fund (by the federal government alone or by the federal and state governments together); whether to lend initial funds directly or to create a reserve fund against which larger sums could be borrowed (and then lent); and who should administer the fund (a new independent agency or an existing department). While none of these bills was enacted into law, Congressional interest in such revolving funds remains high.

6. See H.R. 1776 and H.R. 2818, among others.

CHAPTER II

WATER UTILITIES' NEED FOR CAPITAL, FISCAL YEARS 1984-2000

In the coming decades, municipalities will have to provide water service to populations that, more often than not, are growing. This chapter looks at the financial burden of supplying this water. The first section describes the methodology used to forecast regional capital spending for water supply. A second section presents projections of annual capital expenditures for water supply improvements from 1984 through 2000, and compares this spending with actual annual spending from 1977 through 1983. The chapter closes with some notes about the limitations of the estimates.

METHODOLOGY

Water utilities' demand for capital improvements depends ultimately on the demand for their water. Consequently, projections by the Congressional Budget Office (CBO) of capital spending begins with estimates of water demand. In forecasting this demand, CBO assumed that per capita usage would not change between 1984 and the end of the century; changes in water demand, therefore, reflect only changes in population. Using Census Bureau population projections, CBO forecast water use in the year 2000 for 10 different sizes of water systems within each Census region.

For each system size and region, CBO considered the demand for two kinds of capital improvements: those needed to replace existing facilities as they age, and those necessitated by growth in the demand for water. Where population (and, by assumption, water demand) grew by less than 20 percent, CBO assumed that only replacement spending would be needed, as the average existing system can deliver 20 percent to 40 percent more water than it currently has to provide. 1/ Where population grew by 20

1. National Association of Water Companies, *Financial and Operating Data--1983* (Washington, D.C.: National Association of Water Companies, no date); and American Water Works Association, *1981 Water Utility Operating Data* (Denver: American Water Works Association, 1981).

percent or more, CBO estimated the cost of providing additional facilities to meet this new demand.

The CBO estimated separately the cost of treating water, distributing water, and developing new sources of water supply. Treatment costs depended on whether the water came from a groundwater source, from a surface water source, or from some combination of the two; a system's water source, in turn, was a function of the system's size. The cost of both distributing and developing new sources of water also depended on the size of the water system. All costs were estimated using standard cost functions found in the engineering literature (see the appendix).

In order to compute an upper bound on the amount of capital spending that would be needed, CBO assumed that all capital spending, both for replacement and for expansion, would take place at the beginning of the forecast period. These costs then were amortized over the life of the component being built to reach an estimate of annual spending. 2/

CAPITAL EXPENDITURES FOR WATER SUPPLIES

From fiscal years 1977 through 1983, water utilities spent an average $4.7 billion annually to replace and expand local water supply facilities. 3/ The CBO estimates that these utilities will spend nearly the same amount--$4.5 billion annually--from 1984 through 2000. About 60 percent of this amount will be used to replace existing facilities; the remainder will provide facilities for expanded service. Whether these aggregate spending figures represent a stable financial burden to the customers of individual utilities depends on how this spending is distributed geographically and on the number and incomes of the people who must foot the bill.

Regional Capital Expenditures

Table 5 shows annual capital spending for each of the nine Census regions during the 1977-1983 period. The aggregate figures give little sense of the

2. Each component was assumed to last at least as long as the forecast period. The design lives were assumed to be 20 years for well fields, 30 years for treatment facilities, and 75 to 200 years for distribution systems (reservoirs were assumed not to need replacement).

3. Unless otherwise noted, all dollar amounts in this chapter are measured in 1984 dollars.

TABLE 5. ANNUAL CAPITAL SPENDING FOR MUNICIPAL WATER SUPPLIES, FISCAL YEARS 1977-2000, BY REGION (Ranked by percentage change in per capita spending)

Region	Annual Capital Spending 1977-1983 (In millions of (1984 dollars)	Annual Capital Spending 1984-2000 (In millions of 1984 dollars)	Percent Change in Annual Capital Spending	Annual Per Capita Spending 1977-1983 (In 1984 dollars)	Annual Per Capita Spending 1984-2000 (In 1984 dollars)	Percent Change in Annual Per Capita Spending	Forecast Per Capita Capital Spending as a Percent of 1983 Personal Income
Total United States	4,695.00	4,493.00	-4.30	24.61	21.80	-11.42	0.185
Mid-Atlantic	308.25	421.00	36.58	9.96	14.27	43.26	0.112
West-North Central	276.28	304.00	10.03	19.12	20.57	7.58	0.183
East-North Central	484.55	508.00	4.84	13.83	14.53	5.08	0.126
New England	146.35	143.00	-2.29	14.09	13.60	-3.49	0.104
Pacific	824.68	811.00	-1.66	31.47	26.34	-16.31	0.203
East-South Central	290.25	249.00	-14.21	23.55	18.70	-20.58	0.205
Mountain	522.74	525.00	0.43	54.45	41.60	-23.61	0.381
West-South Central	767.61	676.00	-11.93	38.27	28.95	-24.34	0.263
South Atlantic	1,074.41	856.00	-20.33	34.44	23.57	-31.54	0.211

SOURCE: Congressional Budget Office.

different burden that this spending imposed on each region, for the spending was paid for by populations of quite different sizes. The data showing spending per capita are more revealing. Nationwide, per capita capital spending for water supply averaged $24.61 per year. Across regions, capital spending varied widely, from $9.96 per capita in the Mid-Atlantic region to $54.45 per capita in the Mountain states.

A number of factors contribute to this spending diversity. Most important are regional differences in population growth. Regions often build water supply facilities in anticipation of population gains. Thus, other things being equal, investment per capita will be higher in those regions expecting the most rapid population increases.

The variation in spending also reflects regional differences in the cost of supplying water. These cost differences arise in part from the relative scarcity of water in each region. While the need for treatment and distribution are similar throughout the country, the cost of impounding surface water and transporting it to the areas where it is consumed is far greater in the West than in the East. Cost differences also rise from regional variation in the prices of the land and labor needed to build water supply facilities. 4/ Further, the economies of scale that characterize water supply technology reduce the cost per gallon as the system increases in size. Thus, water is generally cheaper to produce in those regions with a greater share of their populations in large urban areas.

Finally, an area's economic health will affect its capital spending. When regional income falls, capital improvements are often deferred until better economic circumstances return. Not surprisingly, regional capital spending on water supply from 1977 through 1983 is correlated with growth rates in regional personal income.

The CBO projects that, for the country as a whole, annual capital spending for local water supply will be 11 percent less per capita from 1984 through 2000 than it was from 1977 through 1983 (see Table 5). The change in per capita spending will vary widely by region. In six of nine Census regions, per capita spending will fall; the spending declines will range from 3 percent in the New England area to 32 percent in the South Atlantic region. Per capita spending will rise in three regions; but in two of these regions the increase will be less than 10 percent. In only one region, the Mid-Atlantic,

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4. "Materials and Labor Cost Trends in the U.S.," *Engineering News Record (March 19, 1981), pp. 132-137.*

will per capita capital expenditures rise sharply; there they will increase by over 40 percent.

In general, per capita expenditures will decline in those regions currently spending the most and will rise in those regions now spending the least. Since estimated capital spending for water supply is in large measure a function of the size and distribution of population within each region, CBO's projections of water supply expenditures show spending becoming more uniform as the population distribution becomes more uniform. Those regions where population grows and becomes more concentrated in larger cities will be able to take better advantage of the economies of scale in water supply facilities. Conversely, where population falls, regions will be spreading the cost of replacing aging facilities over a smaller population, causing per capita costs to rise.

Despite the greater uniformity in spending, substantial regional differences will remain: per capita spending in the New England region will be only one-third as much as in the Mountain region. Whether these differences in per capita spending reflect different economic burdens depends on the wealth of the individual regions. Correcting for differences in regional personal income shows that there will indeed be large variations in the individual burden imposed by capital improvements for water supply. For example, capital spending as a percent of personal income will be three and one-half times as great in the Mountain region as it will be in the New England states (again, see Table 5).

The Mid-Atlantic region faces the most dramatic change in per capita capital spending. From 1977 through 1983, states in the Mid-Atlantic region spent $9.96 per capita; from 1984 through 2000, spending will rise to over $14 per capita. The reasons for the magnitude of this rise remain elusive. Most likely, the increase in aggregate spending reflects a return to the standard replacement schedule assumed in CBO's analysis after deferring maintenance during the 1977-1983 period--a time of urban fiscal crisis in the region. Despite the large percentage increase in spending, however, residents of the Mid-Atlantic will face one of the lowest financial burdens in the nation: per capita spending, both in dollars and as a percent of personal income, will be lower in this area than in all but one other region, and will be only 30 percent of the amount spent by the Mountain states.

Capital Spending by System Size

The CBO's projections of aggregate and per capita capital expenditures by system size are shown in Table 6. By themselves, the aggregate figures

TABLE 6. ANNUAL AGGREGATE AND PER CAPITA CAPITAL SPENDING, BY NUMBER OF PEOPLE SERVED, FISCAL YEARS 1984-2000

Type of Spending	More than 1 million	100,000 1 million	50,000-100,000	25,000-50,000	10,000-25,000	5,000-10,000	2,500-5,000	1,000-2,500	Fewer than 1,000	Total
Aggregate Capital Spending (In millions of 1984 dollars)										
Source Development	3	25	12	12	14	10	8	11	13	107
Treatment Facilities	24	196	137	195	316	228	178	174	119	1,565
Distribution Systems	84	576	310	428	591	387	268	104	35	2,783
Total	111	797	459	635	921	625	454	289	167	4,455
Per Capital Capital Spending (In 1984 dollars)										
Source Development	.36	.48	.48	.41	.40	.52	.68	1.17	2.55	.52
Treatment Facilities	1.25	3.76	5.52	6.60	9.08	11.77	15.06	18.59	23.36	7.59
Distribution Systems	4.37	11.05	12.50	14.49	16.98	19.98	22.68	11.11	6.87	13.50
Total	5.78	15.29	18.51	21.50	26.47	32.27	38.41	30.87	32.78	21.61

SOURCE: Congressional Budget Office.

reveal little; again, the per capita data tell a more interesting story. Those data reflect the economies of scale that characterize water supply technology. In general, the larger the system, the less it will spend per person served. The difference between the largest system and the smallest in per capita capital spending is striking: systems serving more than 1 million people will spend an average of $5.78 per person each year; systems serving between 2,500 and 5,000 people will spend nearly 7 times that amount. The economies of scale are more pronounced in water treatment than in water distribution. Per capita expenses for water treatment will average 95 percent less for the largest systems than for the smallest ones. In contrast, per capita distribution costs will be only 33 percent less for the largest systems than for the smallest ones.

Capital Spending by Component

Between 1984 and the turn of the century, spending by utilities on water distribution facilities will total $2.8 billion annually, almost two-thirds of their annual capital spending (see Table 6). Spending on water treatment facilities will account for $1.6 billion annually, about 35 percent of utilities' capital budget. New sources of supply will claim only 3 percent of expected capital spending.

Capital spending for distribution systems will be divided fairly evenly between replacement of existing facilities and additions of new facilities to meet growing water demand. In contrast, less than 20 percent of the spending for water treatment will be to add new capacity. These numbers again reflect the greater economies of scale that characterize water treatment: as population rises, the per capita increase in spending will be less for treatment than for distribution. Of all capital spending for water supply, about 60 percent will be used to replace existing facilities; the remainder will be used to provide water to a larger population.

LIMITATIONS OF CBO'S CAPITAL SPENDING PROJECTIONS

The capital spending estimates presented in this paper are the first ever made at this level of detail. 5/ To make the forecasting problem tractable,

5. Earlier estimates can be found in American Water Works Association, *AWWA Infrastructure Survey of the 50 Largest Water Utilities* (Washington, D.C.: AWWA, 1983); and The President's Intergovernmental Water Policy Task Force, *Urban Water Systems: Problems and Alternative Approaches to Solutions* (Washington, D.C.: Water Policy Task Force, 1980).

CBO made a number of simplifying assumptions. Most of these simplifications worked to exaggerate the changes, both positive and negative, in each region's capital spending.

One problem arises from the assumption that per capita water use will remain unchanged. Water use can be constant only if there is no change in either the price of water or the way in which water is used. 6/ In fact, numerous new water conservation techniques have recently become available, often in direct response to increasing water prices. And, of course, capital spending does influence water prices, especially for regulated private firms, whose prices are explicitly tied to capital costs. Thus, even in a world without technological change, rising per capita spending will increase prices and decrease the demand for both water and further capital improvements in water supply. Conversely, in regions where per capita spending falls, price declines will increase both water consumption and the amount of capital spending required. Had capital spending estimates taken account of the price sensitivity of water demand, neither the projected rises in capital spending nor the projected declines would have been as great.

In a similar vein, CBO assumed that all replacement and expansion will be done with current standard engineering techniques. Yet water, like most other goods, can be produced using a variety of technologies. As capital spending (and thus the price of water) rises, production managers will come under pressure to substitute less capital-intensive production techniques for existing methods. 7/ Thus, again it is unlikely that changes in capital spending will be as great as envisioned in the CBO forecast.

Finally, CBO assumed that national cost functions can adequately measure costs in each of the different regions despite evidence that the cost of water supply differs by region. To the extent that regional costs do differ, CBO projections will understate the expenses faced by the high-cost regions and overstate the expenses of the low-cost regions. Therefore, while CBO projects that capital spending will fall in the high-cost areas and rise in the low-cost ones, both the projected increases and the projected declines in spending are overstated.

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6. The effect of price changes on water use is discussed in Kenneth Frederick, ed., *Scarce Water and Institutional Change* (Washington, D.C.: Resources for the Future, Inc., 1986), p 116.

7. Some alternative approaches to water supply problems are discussed in Chapter III.

While all of the simplifications noted above bias CBO's forecast of regional capital spending, at least the direction, if not the magnitude, of their bias is clear: all cause the capital spending projections given here to overstate the change in each region's spending. A final simplification understates the spending that will be needed in each region: the estimates do not reflect the cost of complying with the standards now being developed pursuant to the Safe Drinking Water Act of 1984.

CHAPTER III

STATE AND LOCAL OPTIONS: ALTERNATIVE SOLUTIONS TO WATER SUPPLY PROBLEMS

The analysis in Chapter II shows that capital spending for water supply will rise substantially in only one Census region through the rest of this century. The aggregate data used in that analysis, however, disguise the fact that individual communities in other regions also may face large increases in capital spending. In many instances, part of these increases could be avoided. Some state and local agencies have recently begun to pursue new methods to meet the demand for water. This chapter discusses some of these options, including water conservation strategies, water supply technologies that require less capital spending than do current methods, and financial innovations that reduce the cost of borrowing for the capital requirements that remain.

LOCAL OPTIONS: DEMAND MANAGEMENT

Faced with demands for greater water supplies, water authorities must either increase supplies or help users find ways to use existing supplies more efficiently. Among the methods that local authorities could use to reduce water consumption are rate reforms and education campaigns.

Reforming price schedules holds particular promise. While most public water utilities charge prices that are more than sufficient to cover operating expenses, few charge enough to cover the depreciation of capital facilities as well. Charging prices below the real cost of providing water leads to overconsumption. Without signals about the true cost of water, consumers demand more than they would if they paid the full cost of their consumption. The result is overinvestment in water supply facilities.

In designing rate structures that reflect costs, utilities need to consider not just average prices, but also the time of day and/or the season in which water is consumed. Because utilities must invest in enough capacity to meet demand at peak times, they would need fewer facilities--and thus less investment--if some customers switched their consumption from peak to off-peak periods. Recognizing this, the City of Los Angeles

recently began to charge higher prices in the dry season in hopes of reducing peak demand.

Evidence on the effect of price changes on water demand suggests that the savings from proper pricing policies can be significant. Studies of urban water supply show that a 10 percent rise in price will cause consumption to fall between 3 percent and 11 percent. 1/ International comparisons reflect a similar price sensitivity of urban water demand. In the United States, where water costs about $1 per 100 gallons, per capita consumption averages about 100 gallons per day; in most European cities, where water generally costs more than twice as much, consumption is about half of the U.S. level. 2/ A recent study of the Metropolitan Water District of Southern California illustrates the size of potential savings that could result from prices that fully reflect the cost of providing water. Although the population of this district is expected to grow dramatically in the next 15 years, it would need no new water supplies until 2000 if it charged prices that reflected the true cost of furnishing water. 3/

In addition to reducing the demand for water, price reform could bring water utilities more capital at lower interest rates. As higher rates increase utilities' revenues, investors become more willing to finance capital improvements. For example, a recent survey of the largest publicly owned water systems found that rate increases could secure more money at lower interest rates than would otherwise be available. 4/

Finally, some utilities can reduce demand by educating consumers about conservation techniques. Education campaigns have been successful both as short-term responses to drought and as a means of altering long-

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1. See the studies cited on p. 116 of Kenneth Frederick, ed., *Scarce Water and Institutional Change* (Washington, D.C.: Resources for the Future, Inc., 1986).

2. See Association of the Proprietors of Waterworks Companies in the Netherlands, *Waterworks Statistics 1979* (The Netherlands: Association of the Proprietors of Waterworks Companies in the Netherlands, 1984); and Kenneth Frederick, ed., *Scarce Water*, p. 6.

3. Richard Wahl and Robert Davis, "Satisfying Southern California's Thirst for Water: Efficient Alternatives," in *Scarce Water*.

4. American Water Works Association, *AWWA Infrastructure Survey of the 50 Largest Water Utilities* (Washington, D.C.: American Water Works Association, 1980).

term water use habits. 5/ The city of Madison, Wisconsin provides an example of the extent to which education campaigns can affect demand. Madison ran a campaign that informed residents of the capital expenditures that would be needed if peak demand did not fall, and urged them to shift some water use from peak consumption times. The $40,000 campaign lowered peak demand enough to allow the city to forgo a new well system, thus saving $175,000 in construction costs and $60,000 in annual operating expenses. 6/

STATE OPTIONS: ALTERNATIVE SUPPLY TECHNIQUES AND FINANCIAL INTERMEDIATION

Local water authorities have limited options for solving water supply problems, as they operate within a legal and institutional environment created by state governments. State law influences local water supplies directly through rules on water use, the distribution of water rights, and the regulation of local water utilities and indirectly through control of local jurisdictions' power to tax, incur debt, and assess user fees. Because their influence over local water utilities can be substantial, state governments could play a major role in fostering new approaches to the water supply problems of local utilities.

Trading Water Rights

In 17 western states, current water users hold rights to more water than is available in an average year. Supplies to meet the growing demand for water will have to come either from conservation or from reallocation of the rights to existing supplies. This section examines the prospects of alleviating water supply problems by establishing markets in which water rights can be traded.

Markets work well only if there are unambiguous, transferable, and quantifiable property rights attached to the good being traded. Such rights for water rarely exist under current law. The ambiguity of property rights arises in part from administrative policy and in part from the fact that a

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5. Mark Hoffman and others, "Urban Drought in the San Francisco Bay Area: A Study of Institutional and Social Resiliency," in *Water Conservation Strategies* (Washington, D.C.: American Water Works Association, 1980).

6. Larry Diebert, "Fiscal Planning and Water Conservation in Madison, Wisconsin," in ibid.

body of water may be subject to the (sometimes conflicting) laws of more than one state, the federal government, and various international treaties. (Especially problematic are treaties between the federal government and various Native American nations, treaties whose provisions are currently being adjudicated.) 7/ When more than one body of law may apply, assured property rights await interstate compacts, Congressional action, and/or court rulings. Until the rights to water are made unambiguous, the transfer of water rights will be discouraged by the uncertainty surrounding the legality of such trades.

Markets also require property rights that are transferable. The transferability of water rights varies by state and, in general, depends on which one of two principles is used by state water law. 8/ In the East, water law generally follows the "riparian" or "correlative" rule--that is, surface water can be used only on land abutting a water flow; groundwater can be used only on land overlying an aquifer. Riparian law grants the right to water only for "reasonable and beneficial" use. Where claims exceed the available water, all users must share the water equitably. Riparian law does not readily accommodate water transfers; selling water rights is often ruled out by the prohibition against using the water on land that is neither adjacent to the surface water nor overlying the aquifer. Where riparian law applies, trading water rights offers little promise for efficient distribution of water use. (Methods more useful in these areas are discussed in the following section.)

In western states, the doctrine of "appropriative" rights governs the use of surface water. Here, rights are established on a first-come, first-served basis: the right to use water accrues to the entity that first puts the water to "reasonable and beneficial" use, even if the use is on land far from the water source. Those who subsequently seek water may establish "junior" water rights. These junior rights are filled each year only if water remains after the holders of more senior rights receive their full quota. Once established, a water right remains with the original holder as long as the water continues to be used "beneficially."

Appropriative rights were designed to bring about the settlement and agricultural development of the West. By allowing water to be transported from those areas in which it was abundant to the large tracts of open, arid

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7. See, for example, the discussion of water rights in the Columbia River Basin in Kenneth Frederick, *Scarce Water*, Chapter 2.

8. Water law is governed by both principles only in California. See ibid., Chapter 4.

land that were common in the West, the law helped to accomplish exactly what it was intended to do. But the requirement that the right to water remains with those who continue "reasonable and beneficial" use works against any change in the original distribution of water. Until transferring the right to water is designated explicitly as a "reasonable and beneficial" use, uncertainty over the legality of trades will stand in the way of establishing water markets.

If transfers are not regarded as a beneficial use of water, then appropriative water law provides large incentives against conservation. Water not used by the entity originally entitled to it becomes "surplus" water to which others can establish appropriative rights. Thus, those conserving water save only the cost of the water not used; they gain nothing from the fact that the water can be used by others who attach a far higher value to it. One cost of this arrangement is that, in water-short years, senior water holders who receive their full quota have no incentive to share that water with the holders of junior rights who receive no water.

A final complication arises from the nature of water itself: transferring water from a stream or an aquifer can affect third parties--those downstream and those who share use of the aquifer. Markets for water rights would work efficiently only if trades take into account the effect of water transfers on third parties.

Despite these difficulties, voluntary water transfers do occur under current law, and in recent years they have become more common. While most transfers result from individual negotiations among the affected parties, some fledgling water markets have been started. These markets are limited in scope. Trade usually occurs only between members of the same water district, and often the price is set by an administrator at the cost of supplying water, not by the market at the level people are willing to pay for water. 9/ That these transfers occur despite the lack of supporting institutions and despite the legal complexities involved suggests that much more could be gained were the legal and institutional climate made more conducive to trade. 10/

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9. For a survey of current water transfer agreements, see Richard Wahl and Frank Osterhoudt, "Voluntary Transfers of Water in the West," in U.S. Geological Survey, *National Water Summary 1985* (Washington, D.C., 1986).

10. Ibid. Chapter IV of this paper discusses changes in federal policy that could promote markets for water rights.

System Interconnection and Joint Operation

For most areas in the eastern United States, water is not scarce, but simply inefficiently distributed. The water utility industry has a strong tradition of local autonomy. Even small jurisdictions within larger metropolitan areas usually have locally owned and operated water systems. Because localities within a water basin often develop at very different rates, individual systems may face large shortfalls while the basin as a whole has abundant supplies. One solution for a water-short system would be to build new facilities to import water from outside the basin. But water resources engineers have recently developed techniques to use a less expensive alternative: connecting and jointly operating the facilities of all individual systems in a region. 11/

In the greater Washington, D.C., area, for example, the Washington Suburban Sanitation Commission (WSSC) has operated such an interconnected water supply system since 1982. This regionally coordinated system obviated the need for between $200 million and $1 billion in capital investment that earlier had been proposed as a solution to the rapid growth in the region's water demand. 12/ Similarly, a recent study concluded that, to meet future water demand, Virginia Beach, Virginia, could save half the cost of importing water from another basin by coordinating water use among the local systems in its area. 13/

The greatest barrier to system interconnection is a lack of information. Local systems will agree to interconnection and joint operation only if each locality is convinced that its water supply will be assured. In the absence of good information about the effects of joint operation, each locality would be encouraged to adopt a "worst case" scenario in its negotiating stance with the others. In these situations, state governments could serve the role of the honest broker, developing and disseminating information that could be expensive for an individual locality to acquire,

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11. For a description and application of these techniques, see Daniel P. Sheer, "Managing Water Supplies to Increase Water Availablity," in U.S. Geological Survey, *National Water Summary 1985*.

12. Ibid.

13. Leonard Shabman and William Cox, "Costs of Management Institutions: The Case of Southeastern Virginia," in Kenneth Frederick, *Scarce Water*.

although it would be crucial to prospects for any joint operating agreement. 14/

System interconnection is only the most dramatic example of a larger set of improvements in the yields of existing water supply systems that can be achieved by applying advanced engineering techniques. Systems with more than one facility could maximize the yield of the entire system by coordinating reservoir releases or calculating the minimum flows needed for maintaining environmental quality. Similarly, ground and surface water systems could be operated conjunctively, allowing groundwater to substitute for absent surface water during dry seasons and using peak surface water flows to allow aquifers to recharge during wet seasons. An application of this technique in rural Maryland proved more cost effective than all potential new surface construction. 15/

Financial Intermediation

Each state sets the financial rules by which the localities within it must operate. The state decides the level and kind of taxes that localities can levy, the amount of debt that they can incur, and the terms under which they can assume that debt. The state may even determine the kind of prices that local water utilities can charge for water. States could use these sweeping powers to create a legal and institutional climate that minimizes the cost of capital to local water utilities.

In general, states could increase the range of financial instruments available to local water authorities. Many cities operate under financial strictures imposed by state legislatures in the wake of widespread municipal bond defaults during the Great Depression. Since then, of course, localities have become far more fiscally sound and local government administrators have become more sophisticated about financial management. Thus, a Public Works Task Force established by Washington state found that restrictions on localities' freedom to tax and to incur debt raised the local cost of capital for water supply improvements. 16/ A review of laws in

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14. See Chapter 4 of Kenneth Frederick, *Scarce Water* for an example of the difficulty in arranging joint operating agreements in the absence of good information that is accepted by all parties.

15. See Nancy N. Ehrlich, *Managing the World's Largest Reservoir* (Columbia, Md.: Water Resources Management Inc. 1986).

16. Washington Planning and Community Affairs Agency, *The Washington State Public Works Report* (1983).

other states might show a similar need for financial flexibility at the local level.

Specifically, state governments could use their stronger position in credit markets to assist localities more directly. Such direct assistance would be of most help to smaller jurisdictions, which face three handicaps in credit markets. First, many of the costs of borrowing (such as fees for bond counsel, printing, receiving a rating from investment companies, and obtaining some form of credit insurance) cost more per dollar borrowed as the amount borrowed decreases. Second, the smaller the borrower, the lower its credit rating usually is. Lower ratings follow from the higher risk of default that lenders perceive in jurisdictions with economies that are smaller, less diverse, less wealthy, and growing less quickly than larger and more prosperous government units. Finally, smaller systems are likely to seek credit at less frequent intervals and to have less of a credit history. Lenders are chary of unknowns; thus, when small cities are able to obtain credit at all, it is more expensive than the credit available to borrowers with more established records, but otherwise similar characteristics.

Because state governments face none of the handicaps discussed above, they could help to lower local capital costs in a number of ways. A few states borrow directly on behalf of localities. When these states back their bonds with "full faith and credit" (which allows lenders to seek court-ordered taxes to make good on any default), they assume the risk of default by localities. As such, state borrowing on behalf of localities could make it more expensive for the states to borrow for their own purposes.

States could aid local jurisdictions at less cost to themselves by establishing bond pools for local issues. Bond pools could help small issuers in a number of ways; most important, larger issues could take advantage of the economies of scale that characterize credit markets. Also, while small, infrequent issuers individually might lack credit histories, the large pools that combine the issues of an ever-changing set of small issuers could quickly establish the needed history.

One way for state governments to establish bond pools at little or no cost to themselves would be to set up "bond banks" to act as intermediaries between local issuers and credit markets. A state bond bank would issue bonds and use the proceeds to purchase locally issued debt. The local debt would carry an interest rate equal to that paid by the bond bank to its lenders, plus an amount needed to cover the bank's administrative costs. Bond banks usually back their debt in three ways: with payments they receive on the local bonds (in the case of water utilities, these payments usually come out of local utility revenues); by a lien on state-aid payments

to localities; and with a presumption by the lender that the state has a "moral obligation" to repay the bond bank debt in case localities default. 17/

Since 1969, seven states have established bond banks. 18/ Early evaluations show that these banks have had two effects: the bank has made credit available to some localities that previously could not have borrowed at all, and those jurisdictions that could have borrowed on their own were able to do so at a lower cost. On average, the banks lowered local borrowing costs by 4 percent. 19/

The traditional form of bond bank has its limits. First, the bank is most useful when the bank's credit rating is higher than that of the participating localities. 20/ In order to preserve a high rating, a bond bank might need to exclude those localities least able to obtain credit on their own (and consequently most in need of the help that a bond bank could provide). Second, because lenders presume a moral obligation on the part of the state to make good on any bond bank default, the state's ability to get credit for its own purposes might be affected by the credit-worthiness of the bond bank that it sponsored.

States could address both of these concerns by securing bond bank debt with some form of credit enhancement (in which a third party accepts the risk of default in exchange for a fee from the borrower). In return for such guarantees, the bank might need to back its most risky local issues with a reserve fund equal to the size of those issues. 21/ This arrangement would have the twin advantages of making bond bank debt available to those localities most in need of it while simultaneously insulating the state's own credit rating from the credit history of the bond bank. At the same time, however, the bond insurance fee would raise the cost of bond bank debt to

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17. The state's "moral obligation" to back the bank's bonds with general revenues is presumed by the lenders, but carries no legal force.

18. The state with bond banks are Alaska, Arkansas, Indiana, Maine, New Hampshire, Nevada, and North Dakota.

19. Martin Katzman, "Municipal Bond Banking: The Diffusion of a Public-Finance Innovation," *National Tax Journal*, vol. 33 (June 1980).

20. Even if the rating of the bank and its members were the same, the local governments could benefit from the economies of scale that the bank could provide.

21. Reserve funds usually equal one year's debt service payments. As the bond bank established a credit history, the insurer might accept decreasing the size of the reserve fund.

localities, and the unusually large reserve fund would limit the number of local issues that bond bank could assume. 22/

The state and local options discussed in this chapter would require little or no outlays on the part of state or local agencies. In the absence of increased state and local spending, federal capital grants might continue to play an important role in the water supply investment of some localities. The next chapter discusses ways to make these federal programs more efficient.

22. Nancy Humphrey and Christopher Walker, *Innovative State Approaches to Community Water Supply Problems* (Washington, D.C.: Urban Institute, 1985), p. 45.

CHAPTER IV

FEDERAL POLICY ALTERNATIVES

By providing support for municipal water supplies, the federal government has sought to further several, sometimes conflicting, goals. These goals have included increasing the availability and quality of local water supplies, promoting efficient state and local policies to provide water supplies, and furthering local economic development. When considering the future direction of water supply policy, the Congress may wish to add a further goal: reducing the federal deficit. This chapter examines several alternatives for federal policy, including reducing federal support for municipal water supplies, as called for in the Administration's most recent budget request, and maintaining the existing level of support either through current programs or through new federal initiatives.

REDUCE OR ELIMINATE FEDERAL FINANCIAL AID FOR LOCAL WATER SUPPLIES

The Administration's budget request for fiscal year 1988 calls for sharply reducing federal grants and loans for municipal water supplies. Specifically, the 1988 request would reduce Community Development Block Grants (CDBGs) and eliminate the water supply grant and loan programs of the Farmers Home Administration (FmHA), Economic Development Agency (EDA), and the Appalachian Regional Commission (ARC). The Administration's proposals would lower federal spending by more than $200 million annually over the 1988-1992 period, compared with spending under current law.

The effect of these cutbacks on the availability and quality of local water would depend in part on how much local entities increased their spending as federal funding was reduced. Evidence from other federal programs suggests that local sources would replace about 70 percent of any reduction in federal funds. 1/ In addition, state and local governments might seek to obviate the need for many spending increases by exploring

1. See Congressional Budget Office, *Federal Policies for Infrastructure Management* (June 1986), pp. 80-86.

more fully alternative supply methods like those discussed in Chapter III. These included various demand management techniques, state efforts both to improve local access to capital and to lower its costs, and state help to increase the role of markets in determining the allocation of water supplies. These state and local options could mitigate to some extent the effects of reduced federal spending for water facilities.

MAINTAIN CURRENT SUPPORT FOR MUNICIPAL WATER SUPPLIES

The Congress may wish to maintain the existing level of federal support for municipal water supplies. If, as shown in CBO projections, per capita spending declines in most regions through the rest of the century, continued federal support would allow nonfederal agencies in most areas of the country to reduce their per capita capital spending. This section considers policies that would continue current federal support for municipal water supplies while furthering other goals, such as reducing the federal deficit.

Facilitate Voluntary Transfers of Federally Controlled Water

In the 17 western states where current water rights exceed the average annual supply, the demand for water continues to rise. 2/ A few states have sought to meet this growing demand by establishing laws and institutions that encourage the exchange of water rights. Facilitating the exchange of water rights allows water to be allocated first to those who value it the most. Most of these transfers have involved the purchase of water by municipal and industrial (M&I) users from agricultural users who hold senior rights. Because agriculture currently consumes such a large fraction of western water, small reductions in agricultural use (through conservation, for example) have permitted increases in M&I use that are proportionately far larger. Given current consumption rates, a 5 percent reduction in western agricultural use of water, for instance, would permit a 50 percent increase in western M&I use. 3/ Because of the high price that M&I users often are willing to pay for water, agricultural users might find it profitable to conserve and then sell the saved water to M&I users.

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2. Much of the information in this section is drawn from Richard W. Wahl, "Promoting Increased Efficiency of Federal Water Use Through Voluntary Water Transfers," (Washington, D.C.: Resources for the Future, 1986, review draft).

3. Calculated from data in ibid., p. 48.

State governments have primary responsibility for deciding the extent to which water transfers are allowed, as nearly all water rights, including rights to water from federal water projects, are held under state law. In those states that encourage water transfers, however, the federal role may be significant: nearly 20 percent of western agricultural water is delivered by Bureau of Reclamation projects, and users of that water must comply with federal as well as state rules governing its distribution.

Currently, both reclamation law and the administrative practices of the Bureau of Reclamation impede the trading of water rights. Most of the limitations arise from restrictions written into the long-term contracts that control the use of bureau-delivered water. A small number of these contracts ban outright the resale of water; most others hinder water transfers in lesser ways. For example, many contracts allow bureau water to be resold, but then minimize the incentive for doing so by restricting (and sometimes eliminating) the amount of profit that bureau customers can make from such sales. A majority of the contracts also limit both the lands on which the project water can be used and the purposes toward which the water can be put. (Most often, use is limited to irrigation.)

Some of the restrictive provisions in bureau contracts can be changed only by an act of the Congress. For example, many of the limits both on the lands served by bureau projects and on the end-use of bureau water are contained in the authorizing legislation for particular projects. Other contract restrictions could be removed by bureau action alone. These are restrictions that reflect the Congressional intent of an earlier era; as the Congress broadened the purposes of various reclamation projects, many already existing contracts were not amended to reflect the evolution of Congressional intent. The bureau could remove these impediments to water transfers simply by offering to amend those contracts that were written in what is now an unnecessarily restrictive fashion.

Some limits on water transfers arise from the administrative practices of the bureau itself. One problem lies in the lack of an explicit bureau-wide policy on water transfers. The absence of such a policy has led to practices that vary widely across projects. At the Central Valley project in California, water can be transferred, but profiting from such transfers is prohibited; in Idaho, a state water bank allows the sale of water at prices set by an administrator; and finally, water from the Big Thompson project in Colorado is traded freely in a true market for water. As these varying practices illustrate, the lack of an explicit policy does not stop trading, but it does make trading more difficult. Since agreements cannot be structured to comply with explicit guidelines, traders must negotiate transfer terms

while somewhat in the dark about what the bureau will approve, and then hope that those terms will be acceptable. The uncertainty surrounding such approval lessens the number of people willing to incur the cost of negotiating a trade.

Similar uncertainty is created by the bureau's retention of state water rights to some bureau-delivered water. The bureau currently holds water rights to about 85 percent of the water that it delivers. 4/ Some bureau officials hold that transferring those rights to its customers would not expedite the development of water markets. And indeed, some users of bureau water have traded not the water right itself, but instead the contract that entitles the holder to bureau water; in essence, these users have "subcontracted" bureau water. Continued bureau possession of the rights to this water, however, raises the possibility that the bureau someday might attempt to restrict such "subcontracting." While transferring rights to other customers is not necessary for transfers, it definitely could encourage trading by reducing the associated uncertainty.

Trading water rights would not only reduce the cost of local water supplies (by eliminating the need for more expensive capital projects), but also would increase federal revenues by raising both payments to the Bureau of Reclamation and federal income tax revenues. The federal government initially pays for bureau projects; the users of water from these projects then pay back some fraction of that cost. The fraction repaid varies with the use to which the water is put. Because M&I users pay substantially more than agricultural users, water transfers would increase payments to the bureau. 5/ Water transfers also would increase income tax payments, as, by allocating water more efficiently, such transfers would increase national income. Studies have estimated the income gain from trading water rights would be between $51 million and $370 million per year in California alone. 6/ Presumably, this increase would be subject to personal or corporate income taxes.

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4. Ibid, p. 23.

5. Ibid, p. 36. Preliminary estimates show that, at current interest rates, M&I users would repay more than twice as much as agricultural users.

6. See D. Erkenkotter, "Should California Agriculture Receive Preferential Water Rates?" Working Paper No. 285 (Los Angeles: University of Calif., Western Management Science Institute, 1978); R.E. Howitt and others, "The Economics of Alternative Institutions for Allocating California's Water" (Riverside, Calif: University of Calif., Resources and Environmental Economics Public Policy Group, 1982); and C.E. Phelps, "Efficient Water Use in California: Water Rights, Water Districts and Water Transfers," Rand Publications Service R-2386-CSA/RF (Santa Monica, Calif.: Rand Corp., 1978).

Restructure Requirements for FmHA Loans and Grants

The FmHA provides grants and loans to small, low-income communities in order to promote investment in water supply facilities. The current structure of the FmHA's program, however, unintentionally encourages localities both to choose inefficient, capital-intensive facilities and to maintain those facilities inefficiently. Typically, grant recipients choose projects that minimize the costs that localities must pay, rather than those that cut total costs. Because FmHA grants and loans can be used for capital expenditures but not for ongoing maintenance, local costs are minimized by building facilities that are more capital-intensive and require less maintenance. As a result, FmHA capital grants are higher than they would be if the grant money could be used for both capital and maintenance expenditures. Further, subsidizing only capital expenditures makes it relatively less expensive for communities to forgo maintenance, in that money saved from forgone maintenance is more likely to exceed the money lost when poor maintenance requires earlier replacement of neglected facilities.

FmHA's grant procedures may also discourage proper maintenance. For the last several years, applications for FmHA funding have exceeded the FmHA budget authorization. In deciding which among the qualifying applicants will get funds, FmHA gives priority to those communities with water systems that violate state or county health regulations. This gives communities an incentive to allow their water systems to deteriorate enough to receive priority in funding for FmHA.

A recent survey of FmHA grant and loan recipients in New York state showed that inadequate maintenance is indeed widespread. 7/ A large majority of the grant and loan recipients indicated that the poor maintenance stemmed in part from a lack of information--that is, the FmHA program is targeted to small communities, which can be hard pressed to find the technical and financial information needed to make efficient water supply investment decisions. These officials particularly desired information about water conservation strategies, alternative supply technologies, optimal maintenance strategies, and available capital financing techniques. Thus, even when they receive FmHA money, some communtites might find it difficult to spend efficiently.

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7. Clifford V. Rossi, "An Institutional and Economic Analysis of Rural Water Supply Infrastructure Deterioration in New York State" (Ph.D. dissertation, Cornell University, 1986).

The Congress could address these problems through a number of alternatives. First, the FmHA could begin to provide technical and financial advice directly to communities; alternatively, the Congress could authorize recipients to use FmHA grants and loans to purchase necessary consulting services. The cost of providing this service would partially be offset by the increased efficiency of water supply investments made by FmHA program beneficiaries.

Second, as part of the grant application, the FmHA could require communities to examine specific alternative solutions to their water supply problems (as the Urban Mass Transit Administration (UMTA) currently requires of its grant applicants). This approach would have the advantage of bringing a variety of specific alternatives to the attention of local water supply officials. Yet this alternative has the drawbacks of increasing the importance of grantsmanship in deciding which communities receive FmHA funding and of reducing the relative importance of providing efficient water supply facilities.

Finally, FmHA grants and loans could be conditioned on recipients' willingness to comply with a specific maintenance schedule. Publishing these schedules would be useful for local officials unsure of the optimal maintenance timetables for their plants. The requirement that communities follow predetermined maintenance schedules, however, carries with it the danger that such schedules would be inappropriate for local conditions or that they would be too expensive to develop properly.

Revolving Fund for Water Supply Facilities

The federal government now supports water supply facilities through a variety of direct grant and loan programs. The Congress may wish to consolidate these programs and establish a revolving fund for financing local water supplies. This fund would become a permanent pool of capital from which localities could borrow at below-market interest rates; repayments of the initial loans would in turn be lent to others for further water supply investments.

Two characteristics make the establishment of a revolving fund problematic: the time between Congressional reviews and the amount of the subsidy provided by low-interest loans. Less frequent Congressional reviews of the funding level and purposes of the fund would promote greater predictability of resources that would be provided by the fund. Proponents of less frequent reviews argue that funding stability would allow localities

to take a long-term view in deciding when they should make capital improvements. Funding stability would allow localities to apply for federal assistance when they think it best to make capital improvements, not when federal assistance happens to be available. Yet the greater the time between Congressional reviews, the greater the likelihood that the resources available through the fund would not reflect Congressional spending priorities (either among different kinds of infrastructure or between infrastructure and other needs).

The low-interest loans made from the revolving fund would provide localities with smaller subsidies than they usually receive from federal grant programs for water supply. Lower subsidies might encourage more efficient project selection, for previous research has shown that lowering the federal share of project capital costs encourages localities to seek less capital-intensive solutions to their water supply problems. 8/ The higher federal shares available through grant programs, however, sometimes are necessary to elicit the water supply improvements that the federal government seeks. For example, some state programs that provide subsidized loans have found few takers among the intended beneficiaries--the small, low-income communities with the most pressing water supply problems. 9/ This suggests that a revolving fund might be most useful if the subsidy were tailored to each community's income and the condition of their water supply facilities as is now done with current FmHA grants and loans for water supply.

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8. See Congressional Budget Office, *Efficient Investments in Wastewater Treatment Plants* (June 1985).

9. See Nancy Humphrey and Christopher Walker, *Innovative Approaches to Community Water Supply Problems* (Washington, D.C.: Urban Institute, 1985), pp. 46-47.

APPENDIX

APPENDIX

REFERENCES USED IN CALCULATING FUTURE CAPITAL DEMANDS

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